भारतीय मानक
Indian Standard

IS 17757 : 2022

वस्त्रादि — मोटर वाहनों के लिए टफ्टेड फर्श आवरण — विशिष्टि

Textiles — Automotive Tufted Floor Covering — Specification

ICS 97.150

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Technical Textiles for Mobiltech Applications Sectional Committee, TXD 38

FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Technical Textiles for Mobiltech Applications Sectional Committee had been approved by the Textiles Division Council.

Textile materials are used in automobiles for interior trims and for ensuring comfort and ambience. Automotive floor covering protect the floor of vehicle from dirt, mud and spillage of food and drinks. Floor covering also prevents the base of vehicle from corrosion and glasses from fogging. Automotive carpets are subjected to trafficking in which the assessment of change in appearance is most important. Accordingly, various methods to assess the change in appearance due to effect of varied water, after exposure to heat and humidity, determination of fibre bind through lisson tretrad test, castor chair test and hexapod tumbler test have been incorporated. To ensure the safety of the vehicle, stringent requirements for flame retardancy of floor covering has been specified along with other performance requirements. Apart from above, requirements for sound absorption and transmission loss have also been specified as optional requirements, depending upon the type and style of vehicle.

The composition of the Committee responsible for the formulation of this standard is given in Annex L.

For the purpose of deciding whether a particular requirement of this standard is complied with the final value, observed or calculated, expressing the result of a test or analysis shall be rounded off in accordance with IS 2 : 1960 ‘Rules for rounding off numerical values (*revised*)’. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

TEXTILES — AUTOMOTIVE TUFTED FLOOR COVERING — SPECIFICATION

1 SCOPE

This standard specifies the requirements for tufted carpet fabrics used for floor covering inside the automobiles which include floor of cabin compartment, boot space, utility compartment or any other area.

2 REFERENCES

The standards listed in Annex A contain provisions which through reference in this text, constitute provisions of this standard. At the time of publication, the editions, indicated were valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated in Annex A.

3 DEFINITIONS

For the purpose of this standard, the following definitions shall apply.

3.1 Automotive Tufted Carpet — A carpet in which the pile yarns are inserted into a previously manufactured base fabric by needles like sewing machine needles, and then secured by a coating or an adhesive, intended to be used in vehicles to protect a vehicle's floor from dirt, wear and salt corrosion (*see* Fig. 1).

3.2 Pile — One part of carpet composed by standing yarn and fibers having directivity, and forming as use surface by sticking out of substrate. There are two kinds of piles, one is cut pile, another, loop pile.

3.3 Primary Backing — In a tufted carpet, it is the backing into which the tufts are inserted.

3.4 Tufted Carpet — Tufted carpet is a carpet formed by sewing pile yarn into a first backing (foundation), and then bonding adhesive is applied to the back side of the first backing to hold yarns in place. Afterwards, a second backing resin is placed on the underside of the first baking (foundation) (*see* Fig. 2).

FIG. 1 AUTOMOTIVE CARPET

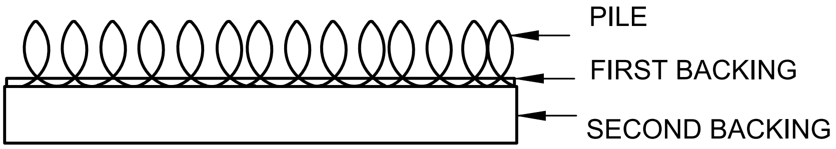


FIG. 2 TUFTED CARPET

3.5 Tufting — A carpet manufacturing process in which pile yarns are inserted, by means of needles, into a pre-made backing fabric. Tufts of "U" shape or "V" shape are produced on a previously woven primary cloth, that is pile inserting fabric. Adhesive is applied on the back side to hold the yarns in the fabric. This cloth may be of cellulosic yarn, jute yarn or made out of synthetic fibres.

4 REQUIREMENTS

4.1 The automotive tufted floor covering shall conform to the requirements as specified in Table 1.

4.2 Sound Absorption and Transmission Loss (Optional)

As agreed to between the buyer and the seller, the automotive tufted floor covering may also be tested for sound absorption and transmission loss by the test method given in ISO 10534-2 and ISO 10140-2 respectively. The requirement for these tests shall be as agreed to between the buyer and the seller.

5 CONDITIONING OF TEST SPECIMENS AND SAMPLING

5.1 Prior to testing, condition the test specimens in a standard atmosphere of 27 ± 2 ºC temperature and 65 ± 5 percent relative humidity for a period of 24 h (*see* IS 6359).

5.2 The sample for testing shall be selected after leaving at least 500 mm from the longitudinal edge and 150 mm from the side edges of the roll.

6 MARKING

6.1 The automotive tufted floor covering shall be suitably marked with the following information:

a) Manufacturer's name, initials or trade-mark;
b) Mass in grams per square metre;
c) Length and width of roll (m);
d) Thickness;
e) Batch No. or Lot No.; and
f) Any other information as required by the buyer or the law in force.

6.2 BIS Certification Marking

The automotive tufted floor coverings rolls conforming to the requirements of this standard may be certified as per the conformity assessment schemes under the provisions of the *Bureau of Indian Standards Act*, 2016 and the Rules and Regulations framed thereunder, and the automotive tufted floor covering rolls may be marked with the Standard Mark.

7 PACKING

The automotive tufted floor covering rolls shall be packed securely so as to allow normal handling and transport without tearing and exposing the contents. Details of the packing shall be as agreed to between the buyer and the seller.

8 SAMPLING

8.1 Lot

All rolls of automotive tufted floor of same mass and thickness manufactured under similar conditions and delivered to a buyer against one dispatch note shall constitute a lot.

8.2 Unless otherwise agreed to between the buyer and the seller, the number of automotive tufted floor to be selected at random from a lot shall be as given in column 3 of Table 2.

8.3 For selection of samples at random from the lot, procedure given in IS 4905 may be followed.

9 NUMBER OF TEST SPECIMENS AND CRITERIA FOR CONFORMITY

Number of test specimens and criteria for conformity shall be as given in Table 3.

Table 1 Requirements for Automotive Tufted Floor Covering

(*Clause* 4.1)

Sl No.	Characteristics	Requirements	Method of Test, Ref to
(1)	(2)	(3)	(4)
i)	Length and width, m	As agreed with a tolerance of ± 1 percent.	Annex B
ii)	Mass, g/m^2	As declared with a tolerance of ± 10 percent.	IS 17657
iii)	Thickness, mm (at pressure foot area of 1000 mm^2)	As declared with a tolerance of ± 10 percent.	Annex C
iv)	Tensile strength, N/cm, *Min*		Annex D
	a) Length wise	100	
	b) Width wise	100	
v)	Elongation, percent, *Min*		Annex D
	a) Length wise	10	
	b) Width wise	10	
vi)	Tear strength, N, *Min*		IS 6489 (Part 2) (single tear)
	a) Length wise	50	
	b) Width wise	50	
vii)	Tuft withdrawal force, N, *Min*	10	IS 16201
viii)	Flame resistance	Shall meet any of the following conditions: 1. Test specimen shall not burn or shall stop burning before flame reaches the index line A. 2. Maximum burn rate is less than 80 mm/min 3. Burning of test piece stops before a duration of 60 s has elapsed after the flame reached the index line A and burn length of portion of test piece after that is less than 50 mm.	Annex A of IS 15061
ix)	Light fastness, grey scale rating, *Min*, exposure energy = 25 MJ/m^2	3	IS/ISO 105 B06, (Condition 3 of Table 3)
x)	Compression ratio, percent, *Min*	30	Annex E
xi)	Compressive elasticity modulus, percent, *Min*	70	Annex E
xii)	Colour fastness to water, rating, *Min*		IS/ISO-105 E01
	a) Change in colour	4	
	b) Staining on cotton and silk fabric	4	
xiii)	Dimensional change due to:		IS 11471
	a) Effect of varied water, percent, *Max*	2	
	b) Heating, percent, *Max*	2	
xiv)	Amount of volatile organic compound, µg/100 cm^2, *Max*		IS 17476
	a) Formaldehyde	0.67	
	b) Acetaldehyde	0.66	
	c) Toulene	2.35	
	d) Xylene	3.36	
	e) Ethyl benzene	2.90	
	f) Styrene	0.85	
	g) Di-n-butyl phthalate	0.15	
	h) Tetradecane	1.28	
	j) Di (2-ethylhexyl) phthalate	0.10	
	k) Acrolein	0.35	
	m) Benzene	0.42	
	n) Total volatile organic compound	19.3	

Table 1 (*Concluded*)

Sl No.	Characteristics	Requirements	Method of Test, Ref to
xv)	Assessment of change in appearance after exposure to heat and humidity	Curling ≤ 2 mm	Annex F
xvi)	Corrosion rate (corrosiveness test), 15 cycles, *Max*	44 µm	Annex G
xvii)	Wear resistance, Grade, *Min*		Annex H
	a) Condition 1	3	
	b) Condition 2	3	
xviii)	Odour and smell test, level of acceptance, *Max*		Annex J
	a) Dry test	2	
	b) Wet test	2	
xix)	Fogging test		Annex K
	a) Method A (Photometric method), Transmittance percent, *Min*	90	
	b) Method B (Gravimetric method), mg, *Max*	2	
xx)	Change in appearance (Hexapod method), grade, colour change after 4 000 cycles	3 or better	IS 17260
xxi)	Change in appearance (Lisson tretrad test):		IS 17486
	a) Determination of mass loss	Test A : Mass loss ≤ 150 mg	
	b) Fibre bind	Test C : Better	
xxii)	Appearance retention assessment (Castor chair test), colour change after 25 000 cycles	3 or better	IS 17477

Table 2 Scale of Sampling

(*Clause* 8.2)

Sl No. (1)	No. of Rolls in the Lot (2)	Sample Size (3)	Sub-Sample Size (4)
i)	Up to 50	3	2
ii)	51-150	5	3
iii)	151-300	8	3
iv)	301 and above	13	5

Table 3 Number of Test Specimens and Criteria for Conformity

(*Clause* 9)

Characteristics	Number of Samples	Criteria for Conformity
Length and width, mass, thickness, tensile strength, elongation, tear strength, tuft withdrawl force, compression ratio, compressive elasticity modulus and wear resistance	According to column 3 of Table 2	All the test specimens shall pass the tests
All other requirements	According to column 4 of Table 2	All the test specimens shall pass the tests

ANNEX A

(*Clause* 2)

LIST OF REFERRED INDIAN STANDARDS

IS No./Other Publication	*Title*
105-B06 : 1998	Textiles — Tests for colour fastness: Part B-06 Colour fastness and ageing to artificial light at high temperatures: Xenon arc fading lamp test
105-E01 : 2013	Textiles — Tests for colour fastness: Part E-01 Colour fastness to water (*first revision*)
513 (Part 1) : 2016	Cold reduced carbon steel sheet and strip: Part 1 Cold forming and drawing purpose (*sixth revision*)
1070 : 1992	Reagent grade water — Specification (*third revision*)
4905 : 2015	Random sampling and randomization procedures (*first revision*)
6359 : 1971	Method for conditioning of textiles
6489 (Part 2) : 2011	Textiles — Tear properties of fabrics: Part 2 Determination of tear force of trouser shaped test specimens (single tear method) (*second revision*)
11471 : 2020	Textile floor coverings and textile floor coverings in tile form — Determination of dimensional changes due to the effects of varied water and heat conditions and distortion out of plane (*first revision*)
15061 : 2002	Automotive vehicles — Flammability requirements
16201 : 2014	Carpets — Determination of tuft withdrawal force
17260 : 2019	Textiles floor coverings — Production of changes in appearance by means of vettermann drum and hexapod tumbler tester
17476 : 2020	Resilient, textile and laminate floor coverings — Test method for volatile organic compound (VOC) emissions
17477 : 2020	Resilient, textile and laminate floor coverings — Castor chair test
17486 : 2020	Textile floor coverings — Determination of mass loss, fibre bind and stair nosing appearance change using the lisson tretrad machine
IS 17657 : 2021/ ISO 8543 : 2020	Textile floor coverings — Methods for determination of mass
ISO 10140-2 : 2010	Acoustics — Laboratory measurement of sound insulation of building elements — Part 2: Measurement of airborne sound insulation
ISO 10534 -2 : 1998	Acoustics — Determination of sound absorption coefficient and impedance in impedance tubes — Part 2: Transfer-function method

ANNEX B

[*Table* 1, *Sl No.* (i)]

MEASUREMENT OF LENGTH AND WIDTH OF AUTOMOTIVE TUFTED FLOOR COVERING

B-1 MEASUREMENT OF WIDTH

B-1.1 Apparatus

A steel tape capable of measuring to the nearest 1 mm.

B-1.2 Conditioning

Prior to testing, condition the test specimens in a standard atmosphere of 27 ± 2 ºC temperature and 65 ± 5 percent relative humidity for a period of 24 h (*see* IS 6359).

B-1.3 Procedure

B-1.3.1 Condition the test specimen as specified in **B-1.2**.

B-1.3.2 Immediately after conditioning lay the automotive tufted floor covering roll on a flat surface so as to fully expose the width without distortions.

B-1.3.3 Measure the width of the specimen at three different places along its length. During measurement, measuring tape shall be placed as nearly as possible at right angle to the edge of the roll.

B-1.3.4 Calculate the average of all three readings and report the average width value.

B-2 MEASUREMENT OF LENGTH

B-2.1 Method A (By Using Roll Length Counter)

B-2.1.1 *Apparatus*

Roll length counter.

B-2.1.2 *Conditioning*

Prior to testing, condition the test specimens in a standard atmosphere of 27 ± 2 ºC temperature and 65 ± 5 percent relative humidity for a period of 24 h (*see* IS 6359).

B-2.1.3 *Procedure*

B-2.1.3.1 Mount the automotive tufted floor covering roll on roll length counter and reset the counter meter to zero.

B-2.1.3.2 Now start the rolling length counter and record the reading after the complete unrolling revolutions.

B-2.1.3.3 The reading on the meter shall be the length of sample in metres.

B-2.2 Method B (By Using Length Measuring Wheel)

B-2.2.1 *Apparatus*

Calibrated length measuring wheel.

B-2.2.2 *Conditioning*

Prior to testing, condition the test specimens in a standard atmosphere of 27 ± 2 ºC temperature and 65 ± 5 percent relative humidity for a period of 24 h (*see* IS 6359).

B-2.2.3 *Procedure*

B-2.2.3.1 Lay out the automotive tufted floor covering completely flat such that surface layer faces upwards.

B-2.2.3.2 Now reset the measuring wheel reading to zero. The reading shall be taken from the point parallel to the test specimen axis, minimum 200 mm away from the edges.

B-2.2.3.3 The measuring wheel shall be rolled over to the complete length of the floor covering roll and the reading in the measuring wheel shall be reported.

B-2.2.3.4 The value so obtained shall be the length of sample in metres.

NOTE — The length of the roll may also be measured with the measuring tape after laying it on a flat surface.

ANNEX C

[*Table* 1, *Sl No.* (iii)]

DETERMINATION OF THICKNESS OF AUTOMOTIVE TUFTED FLOOR COVERING

C-1 PRINCIPLE

The thickness of a specimen of automotive tufted floor covering is measured as the distance between the reference plate on which the specimen rests and a parallel circular presser foot exerting a specified pressure on an area of defined size within a larger area of the floor covering.

C-2 APPARATUS

C-2.1 Thickness Tester, having a circular plane presser foot area of 1 000 mm^2. It shall be capable of exerting pressure normal to the plane of the specimen of 2 ± 0.2 kPa and shall have a means of measuring thickness with an accuracy of 0.1 mm.

C-2.1.1 The reference plate on which the specimen rests shall be plane, of at least 125 mm × 125 mm in size and shall be parallel to the pressure foot.

C-2.2 Straightedge ruler, for brushing the surface of the specimen.

C-3 CONDITIONING

Prior to testing, condition the test specimens in a standard atmosphere of 27 ± 2 ºC temperature and 65 ± 5 percent relative humidity for a period of 24 h (*see* IS 6359).

C-4 PREPARATION OF TEST SPECIMEN

C-4.1 Five specimens of dimensions (75 ± 2) mm × (75 ± 2) mm (length × width) shall be taken.

C-4.2 The specimen shall be selected after leaving at least 500 mm from the longitudinal edge and 150 mm from the side edges of the roll.

C-5 PROCEDURE

C-5.1 Lay the specimen flat and lightly brush the pile lean using the straightedge.

C-5.2 After checking the free movement of circular presser foot shaft, obtain the zero reading at the contact point of circular presser foot and base plate.

C-5.3 Place the specimen on the base plate in such a way that no part of the presser foot come in contact within 20 mm of the edge of the specimen.

C-5.4 Gently lower the circular presser foot on the specimen and note the gauge reading after 30 s at a pressure of 2 kPa.

C-5.5 Repeat the procedure for rest of four specimens as stipulated in **C-5.1** to **C-5.4**.

C-5.6 Calculate the arithmetic mean of five readings and report the thickness to the nearest 0.1 mm.

NOTE — If the automotive tufted floor covering consists of more than one thickness level, the result for each thickness level shall be tested separately.

ANNEX D

[*Table* 1, *Sl Nos*. (iv) *and* (v)]

TEST METHOD FOR TENSILE STRENGTH AND ELONGATION

D-1 PRINCIPLE

The test specimen is extended along its major longitudinal axis at constant speed until the specimen fractures. During this procedure the load sustained by the specimen and the elongation are measured.

D-2 APPARATUS

Tensile testing machine shall be of at least 2 000 N capacity with a constant speed of grip separation of 100 ± 10 mm/min. The grip width shall be at least 50 mm.

The tensile testing machine shall be equipped with suitable grips that do not allow specimen to slip from the grip.

D-3 PREPARATION OF THE SPECIMEN

The dumbbell shaped test specimens shall be prepared, 3 numbers each in longitudinal and transverse direction as shown in Fig. 3.

D-4 CONDITIONING

The test specimens, prior to testing, shall be kept for at least 20 h at 27 ± 2 °C and relative humidity of 65 ± 5 percent.

D-5 PROCEDURE

Measure the width of the specimen and mark the gauge length at 60 mm. Afterwards the specimen shall be secured in the upper and lower grip of the tensile testing machine ensuring that the gauge marks coincide as accurately as possible with the edges of the grip. The grip separation speed of the tensile machine shall be 100 ± 10 mm/min. A reading shall be taken of the maximum force indicated (at break) and elongation is measured with the help of a divider or any suitable measuring device.

NOTE — The test specimens breaking outside the gauge marks shall be discarded.

D-6 CALCULATION

D-6.1 Tensile Strength (N/cm) $T = F/L$

where

T = the tensile strength, expressed, in N/cm;
F = the force, expressed in newton; and
L = the width of test specimen, expressed, in cm.

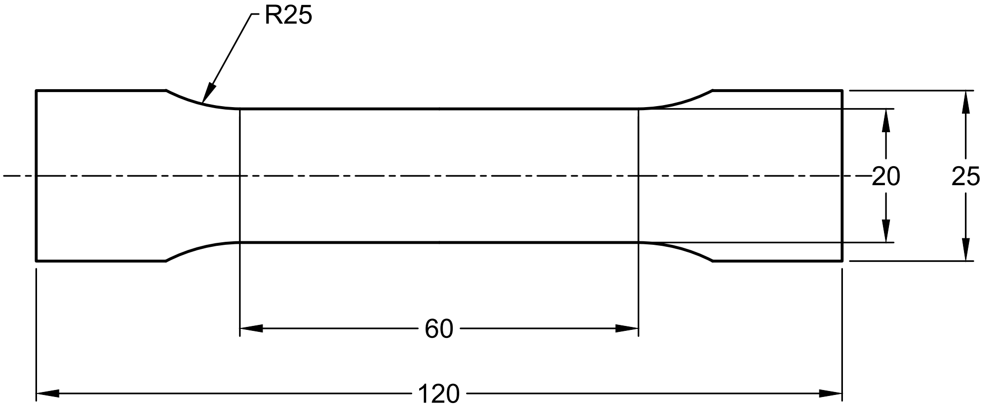
D-6.2 Elongation percent = $\left[\frac{L_2 - L_1}{L_2}\right] \times 100$

where

L_1 = the gauge length of the test specimen expressed, in the mm; and
L_2= the distance between the gauge marks after extension, expressed, in mm.

D-7 EXPRESSION OF RESULT

Average values for tensile strength and elongation shall be reported.



All Dimensions in millimetres

FIG. 3 DUMBBELL SHAPED TEST SPECIMEN

ANNEX E

[*Table* 1, *Sl Nos*. (x) *and* (xi)]

DETERMINATION OF COMPRESSION RATIO AND COMPRESSIVE ELASTICITY MODULUS

E-1 SAMPLE PREPARATION

Cut three specimens of dimensions 50 mm × 50 mm.

E-2 CONDITIONING

Prior to testing, condition the test specimens in a standard atmosphere of 27 ± 2 ºC temperature and 65 ± 5 percent relative humidity for a period of 24 h.

E-3 APPARATUS

E-3.1 Compression Elasticity Tester

E-4 TESTING PROCEDURE AND CALCULATION OF TEST RESULTS

E-4.1 Place the sample in compression elasticity tester and subject it to a pressure of 1.96 kPa (20 gf/cm^2) for a period of 30 s and measure the thickness. Report the value of thickness as t_o.

E-4.2 Remove the load and allow the sample to relax for a period of 5 min.

E-4.3 Now subject the specimen to a pressure of 98 kPa (1 kgf/cm^2) for a period of 30 s and measure the thickness. Report the value of thickness as t_1.

E-4.4 Remove the load and allow the sample to relax for a period of 5 min.

E-4.5 Apply a pressure of 1.96 kPa (20 gf/cm^2) to the specimen for a period of 30 s and measure the thickness. Report the value of thickness as t_o’.

E-4.6 Calculate the compression ratio and compressive elasticity by using the following formula:

E-4.6.1 Compression ratio (percent) = $\frac{(t_0 - t_1)}{t_0} \times 100$

E-4.6.2 Compressive elasticity modulus (percent) =

$$\frac{(t_0 - t_1)}{(t_0 - t_1)} \times 100$$

E-4.7 Repeat the procedure as given in **E-4.1** to **E-4.6** for remaining two samples and calculate the average value of three readings for compression ratio and compressive elasticity modulus.

ANNEX F

[*Table* 1, *Sl No.* (xv)]

ASSESMENT OF CHANGE IN APPEARANCE AFTER EXPOSURE TO HEAT AND HUMIDITY

F-1 OBJECTIVE

To determine dimensional changes due to the effects of varied condition in environmental chamber.

F-2 PRINCIPLE

Operating principle is control of two parameters that are temperature and humidity in closed chamber.

F-3 INSTRUMENT AND APPARATUS

F-3.1 Environmental Chamber, (Temperature range: 5 °C to 85 °C and relative humidity from 10 percent to 95 percent).

F-3.2 Vernier Caliper

F-3.3 Personnel Protective Equipment

F-4 CONDITIONING

Prior to testing, condition the test specimens in a standard atmosphere of 27 ± 2 ºC temperature and 65 ± 5 percent relative humidity for a period of 8 h (*see* IS 6359).

F-5 SAMPLE PREPARATION

Test at least 4 samples of 100 × 100 mm size.

F-6 PROCEDURE

F-6.1 Measure the curling of the test sample before start.

F-6.2 Place all the 4 samples backside down on the glass shelves.

F-6.3 Close the chamber door. The chamber shall not be opened while the test is running.

F-6.4 Chamber shall be set to reach 49 °C and 95 percent relative humidity and samples shall be kept in this condition for 8 h.

F-6.5 In an hour, chamber conditions shall be brought to 16°C and 20 percent relative humidity and samples shall be kept in this condition for 16 h.

F-6.6 One cycle shall be completed as described above.

F-6.7 Measure all four corners of all the 4 samples for final curling. Sample shall not be lifted before measurement.

F-7 ASSESSMENT

Any measurements of curling greater than 2 mm in any of the 4 samples is a product failure.

ANNEX G

[*Table* 1, *Sl No*. (xvi)]

DETERMINATION OF CORROSION RATE BY CORROSIVENESS TEST

G-1 PREPARATION OF TEST SPECIMENS

Take three specimens of dimensions 30 mm × 70 mm (length × width).

G-2 CONDITIONING

Prior to testing, condition the test specimens in a standard atmosphere of 27 ± 2 ºC temperature and 65 ± 5 percent relative humidity for a period of 24 h.

G-3 APPARATUS

G-3.1 Nail

G-3.2 Steel Sheet, of thickness 0.8 mm and dimensions 30 mm × 70 mm (length × width) [*see* IS 513 (Part 1)]

G-4 TESTING PROCEDURE

G-4.1 Measure the weight of the steel sheet.

G-4.2 Perforate the specimens with a total of 35 perforations, 7 in horizontal directions for each 5 vertical perforations, with a nail as shown in Fig. 4.

G-4.3 Place the perforated sample over the steel sheet, in such a way that it’s back surface comes in contact with the steel sheet and the specimen shall be fixed onto it with 5 rubber bands as shown in Fig. 5 with dotted lines.

G-4.4 Immerse the prepared specimen in reagent grade water (*see* IS 1070) for a period of 24 h. The specimen shall then be removed from the solution and shall be hanged freely and vertically until water stops dripping (Step 1).

G-4.5 Moisten the test specimen at a temperature of 50 ± 1 ºC and 50 percent relative humidity for a period of 6 h (Step 2).

G-4.6 Now dry the test specimen at a temperature of 60 ± 1 ºC and 50 percent relative humidity for a period of 6 h (Step 3).

G-4.7 The procedure for all three steps as mentioned in **G-4.4** to **G-4.6** shall be repeated for 15 cycles (times) and the rust occurrence shall be checked.

G-4.8 Now remove the rust completely from the steel sheet. Wash the steel plate with reagent grade water (*see* IS 1070) and dry it with hot air. Measure the weight of steel plate.

G-4.9 Subtract the initial weight of steel plate (before start of test) with weight obtained in **G-4.8** (after test); which is the mass loss in g.

G-4.10 Calculate the corrosion rate from the following formula:

Corrosion rate (µm) =

$$\left[\frac{\text{Mass loss (g)}}{\text{(Specific gravity of iron)} \times \text{(Area of steel sheet)}}\right] \times 10^4$$

NOTE — Specific gravity of iron is 7.76 g/cm^3 and area of steel sheet is 42 cm^2.

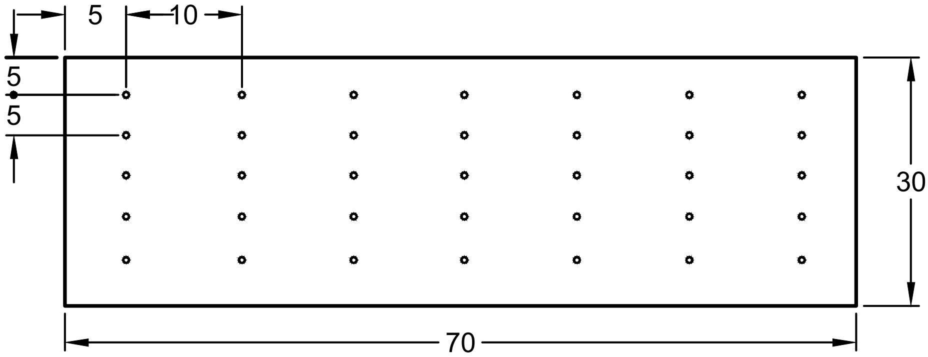


FIG. 4 PERFORATIONS ON TEST SPECIMEN

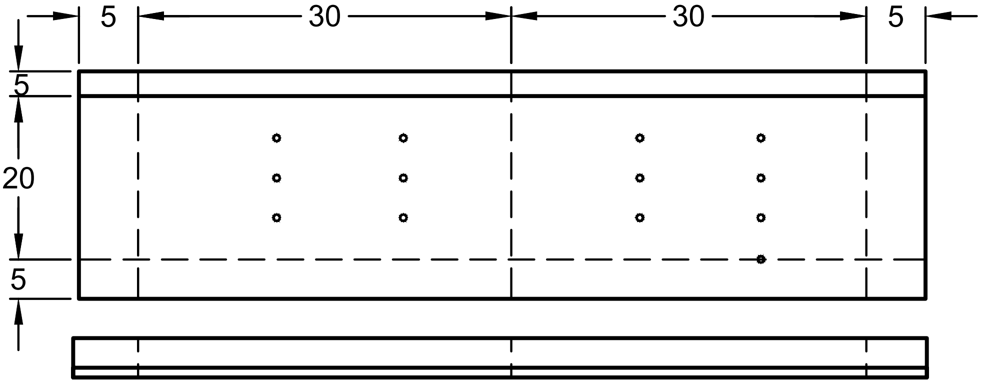


FIG. 5 TEST ASSEMBLY

ANNEX H

[*Table* 1, *Sl No*. (xvii)]

DETERMINATION OF WEAR RESISTANCE OF AUTOMOTIVE TUFTED CARPET

H-1 PREPARATION OF TEST SPECIMENS

Take two round shaped specimens of 130 mm diameter with a concentric hole of 6 mm in the centre of the specimen.

H-2 CONDITIONING

Prior to testing, condition the test specimens in a standard atmosphere of 27 ± 2 ºC temperature and 65 ± 5 percent relative humidity for a period of 24 h.

H-3 APPARATUS

H-3.1 Circular Swatch Cutter

H-3.2 Taber Type Abrasion Tester

H-4 TESTING PROCEDURE

H-4.1 Mount the test specimen on taber type abrasion tester and subject it to the following test conditions separately:

	Abrading Wheel	**Revolving Speed (rpm)**	**Tread of Abrading Wheel (mm)**	**Load (N)**	**Count of Revolution (times)**
Condition-1	CS-10	70	57	4.9	300
Condition-2	H-18	70	57	9.8	100

NOTE — Separate test specimens shall be taken for condition 1 and condition 2.

H-4.2 Remove the test specimens and grading shall be done by analyzing the condition of the specimen as specified in **H-4.3** for each specimen.

H-4.3 Evaluate the grade of wear resistance as given below:

Evaluation Grade of Wearing Test

Class (Grade)	Criteria
5	No change is recognized
4	Slight change is recognized
3	Visible Change is recognized
2	Change is remarkable
1	Change is very remarkable

NOTE — Grade 5 is the best, and become worse as the grade number decrease.

ANNEX J

[*Table* 1, *Sl No*. (xviii)]

ODOUR AND SMELL TEST

J-1 PREAMBLE

This test shall be carried out in both dry and wet conditions to determine the odour rating of the specimens.

J-2 CONDITIONING AND NUMBER OF TEST SPECIMENS

For both the conditions, 3 specimens (total 6) each of size approximately 90 mm × 200 mm (length × width) shall be prepared. Samples shall be conditioned at 27 ± 2 ºC temperature and 65 ± 5 percent relative humidity for a period of 24 h.

J-3 PROCEDURE

J-3.1 Dry Test

J-3.1.1 For dry test, place three specimens in three different wide mouth clean, dry and odourless jars closed with lid.

J-3.1.2 Place one empty wide mouth clean, dry and odourless jar shall be placed as a reference for the test.

J-3.1.3 All jars shall be placed in oven at 65 ± 2 ºC temperature for 1 h.

J-3.1.4 Remove the jars shall be removed from the oven and allowed to cool to room temperature without removing the lid.

J-3.1.5 Select minimum six observers from the staff who do not work in production facilities. Observer shall not be a heavy smoker, user of strong aromatic perfumes and avoid people with sinus problems to become an observer for the test.

J-3.1.6 The first observer’s nose shall be positioned about 2 to 3 cm from the jar and then the lid shall be removed.

J-3.1.7 Observer shall slowly inhale.

J-3.1.8 Record the appropriate rating (refer order rating scale as specified in **J-3.3**).

J-3.1.9 The lid shall not be off the jar longer than 5 s.

J-3.1.10 Conduct the test in an environment free from contaminant odours.

J-3.1.11 Repeat the procedure for each specimen and by all observers (total 18 ratings).

J-3.1.12 Report the highest rating.

J-3.2 Wet Test

J-3.2.1 For wet test, place three specimens in three different wide mouth clean, dry and odourless jars and add 30 ml reagent grade water (*see* IS 1070) into it. Close the jars with lid.

J-3.2.2 Place one empty wide mouth clean, dry and odourless jar as a reference for the test.

J-3.2.3 Place all jars shall be placed in oven at 65 ± 2 ºC temperature for 1 h.

J-3.2.4 Remove the jars from the oven and allowed to cool to room temperature without removing the lid.

J-3.2.5 Select minimum six observers from the staff who do not work in production facilities. Observer shall not be a heavy smoker, user of strong aromatic perfumes and avoid people with sinus problems to become an observer for the test.

J-3.2.6 The first observer’s nose shall be positioned about 2 to 3 cm from the jar and then the lid shall be removed.

J-3.2.7 Observer shall slowly inhale.

J-3.2.8 Record the appropriate rating (refer order rating scale as specified in **J-3.3**).

J-3.2.9 The lid shall not be off the jar longer than 5 s.

J-3.2.10 Conduct the test in an environment free from contaminant odours.

J-3.2.11 Repeat the procedure for each specimen and by all observers (total 18 ratings).

J-3.2.12 Report the highest rating.

J-3.3 Evaluate the odour rating as given below:

Odour Rating Scale

Odour Rating	Criteria
1	No odour
2	Detectable, but not disturbing – acceptable
3	Disturbing - Not acceptable
4	Extremely disturbing - not acceptable
5	Obnoxious
6	Unbearable

ANNEX K

[*Table* 1, *Sl No*. (xix)]

FOGGING TEST

K-1 PRINCIPLE

This test method is used to evaluate the fogging characteristics of automotive trim materials by two methods that is photometric method and gravimetric method.

K-2 APPARATUS

K-2.1 Fog Test Unit, a controlled heating unit with multiple chambers, with a typical temperature range from 60 ºC to 130 ºC. It shall be able to maintain temperature within ± 0.5 ºC.

K-2.2 Dust Free Storage Chamber, with drying agent like silica.

K-2.3 Stamping Device, for preparation of samples.

K-2.4 Beakers

K-2.5 Fluoroelastic Sealing Rings, of size that matches beaker size in use, of 65 ± 5 shore A hardness.

K-2.6 Metal Rings, chrome plated steel of beaker size in use.

K-2.7 Glossmeter Head, suitable for measuring angle of incidence and reflection.

K-2.8 Spacers, of thickness 0.1 ± 0.02 mm.

K-2.9 Float Glass Plate, of thickness 3 ± 0.2 mm. The reflectance of glass shall not vary by more than ± 2 percent.

K-2.10 Magnifier, 40 X.

K-2.11 Forceps

K-2.12 Aluminium Foil

K-2.13 Electronic Weighing Balance, of an accuracy of 0.1 mg.

K-3 PREPARATION OF TEST SPECIMEN

Two circular test specimens of diameter matching the size of beaker shall be taken from uniformly distributed areas of test material.

K-4 PROCEDURE

K-4.1 Photometric Method (Method A)

K-4.1.1 Clean the sealing rings, metal rings, glass plates and beakers.

K-4.1.2 Dry the test specimens in a desiccator with silica gel without using vacuum for at least 24 h.

K-4.1.3 Place the test specimen into the beaker and cover it with the sequence of elastomer seals, glass plates, filter paper/aluminium foil and condenser that is connected to the thermostat.

NOTE — The surface of the glass plate on which the reflectance is to be measured shall face the bottom of the beaker.

K-4.1.4 Heating test temperature of 100 ± 0.5 ºC shall be maintained for a period of 3 h ± 5 min. The thermostat shall maintain the coolant temperature and underside of the condenser shall have a temperature of 21 ± 0.5 ºC.

K-4.1.5 After the completion of test period, remove the glass plate without touching the deposited area.

K-4.1.6 Place the glass plates horizontally in a dust free environment such that the deposited area face upwards.

K-4.1.7 The reflectance value shall be measured after a storage time of 60 ± 30 min.

K-4.1.8 Now place the glass plate on a dull black support and put a spacer on it.

K-4.1.9 Place the reflectometer on the spacer ring and take five readings.

K-4.1.10 Average of these 5 readings shall be the reflectance value.

K-4.2 Gravimetric Method (Method B)

NOTE — Disposable gloves shall be used during the test for handling of aluminium foil. Aluminium foil shall be crease free and contamination free.

K-4.2.1 Weight the aluminium foil with the electronic weighing balance and report as initial weight.

K-4.2.2 Clean the sealing rings, metal rings, glass plates and beakers.

K-4.2.3 Dry the test specimens in a desiccator with silica gel without using vacuum for at least 24 h.

K-4.2.4 Put the specimen into the glass beaker and cover it with sealing rings. Now put the aluminium foil over the sealing ring and press it with the help of rim in order to protect foil from slippage.

K-4.2.5 Clean glass discs shall be placed over the aluminium foil.

K-4.2.6 Now place the beaker in a bath at a temperature of 100 ± 0.3 ºC. The thermostat shall maintain the coolant temperature and underside of the condenser shall have a temperature of 21 ± 0.5 ºC. The test time shall be 18 h ± 0.5 h.

K-4.2.7 Carefully remove the aluminium foil from the sealing rings and place it in the desiccator with fogged side upwards for a drying period of 24 h.

K-4.2.8 Now weight the aluminium foil and report as after test weight.

K-4.2.9 The difference in the final weight after test of the aluminium foil (*see* **K-4.2.8**) and the initial weight (*see* **K-4.2.1**) shall be reported.

ANNEX L

(*Foreword*)

COMMITTEE COMPOSITION

Technical Textiles for Mobitech Sectional Committee, TXD 38

Organization	*Representative(s)*
Northern India Textile Research Association, Ghaziabad	Dr M. S. Parmar (***Chairman***)
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